SECTION 22

WATER LINES

22-01 SCOPE: The work covered by this section of the specification consists in furnishing all labor, plant, equipment, appliances, and materials, not furnished by the Government, and in performing all operations in connection with the construction of water mains and connections to building services at a point approximately 5 feet outside of all buildings and structures to which service is required, complete, and in strict accordance with this section of the specification and the applicable drawings, and subject to the terms and conditions of the contract.

22-02 APPLICABLE SPECIFICATIONS: The following specifications, of the issues listed below but referred to thereafter by basic designation only, form a part of this specification:

a. Federal Specifications:

O-C-114	Calcium Hypochlorite and Chlorinated Lime
QQ-L-156	Lead; Calking
WW-P-325	Pipe, Bends and Traps; Lead (for) Plumbing and Water Distribution
WW-P-421	Pipe; Water, Cast-Iron (Bell and Spigot and Bolted Joint)
WW-P-521b	Pipe-Fittings; Malleable-Iron (Screwed), 150 Pound
WW-T-799a	Tubing, Copper, Seamless (For Use with Soldered or Flared-Fittings)
WW-V-54	Valves, Bronze Gate; 125- and 150 Pound, Screwed and Flanged (for Land Use)
WW-V-58	Valves, Cast-Iron, Gate; 125- and 250 Pound Screwed and Flanged (for Land Use)
WW-P-441a	Pipe; Wrought Iron, Welded, Black and Zinc-Coated

STATINTL b. [redacted]

c. American Water Works Association Specifications:

Standard Specifications for Cast Iron Pipe and Special Fittings

7F.1	Standard Specifications for Gate Valves for Ordinary Water Works Service

22-03 GENERAL: Piping for water mains and building service connections shall be of the types and materials specified herein, shown on the drawings, or as directed by the Contracting Officer. The pipe and accessories shall be of new and unused materials, unless otherwise approved by the Contracting Officer. The full length of each section of

pipe shall rest solidly upon the pipe bed, with recesses excavated to accommodate the bells and joints. Any pipe that has the grade or joint distrubed after laying shall be taken up and relaid. The interior of the pipe shall be thoroughly cleaned of all foreign matter before being lowered into the trench, and shall be kept clean during laying operations by means of plugs or other approved methods. The pipe shall not be laid in water, or when trench or weather conditions are unsuitable for the work, except by permission of the Contracting Officer. Water shall be kept out of the trench until the material in the joints has hardened, or until calking is completed. When work is not in progress, open ends of pipe and fittings shall be securely closed so that no trench water, earth or other substance will enter the pipes or fittings. Any section of pipe found to be defective before or after laying shall be replaced with new pipe without additional expense to the Government.

a. Standard Products: Unless otherwise specified hereinafter, the materials and equipment to be furnished under this specification shall be the standard products of approved U. S. manufacturers regularly engaged in the production of such equipment and shall be the manufacturer's latest standard design.

b. Materials and Equipment Schedule: As soon as practicable and within 45 days after the date of award of contract and before any material or equipment is purchased, the Contractor shall submit to the Contracting Officer for approval a complete list, in triplicate, of Contractor furnished materials, and equipment to be incorporated in the work. The list shall include catalog numbers, cuts, diagrams, drawings, and such other descriptive data as may be required by the Contracting Officer. No consideration will be given to partial lists submitted from time to time. Approval of materials will be based on manufacturer's published ratings. Any materials, fixtures, and equipment listed which are not in accordance with the specification requirements may be rejected.

c. Options of the Government: If the Contractor fails to submit for approval within the specified time, or any authorized extension thereof, a list of materials, and equipment in accordance with the preceding paragraph, the Contracting Officer will select a complete line of materials, fixtures and equipment. The selection thus made by the Contracting Officer shall be final and binding, and the items shall be furnished by the Contractor without change in contract price or time of completion.

22-04 EXCAVATION, TRENCHING AND BACKFILLING shall conform to the applicable provisions of section on EARTHWORK: GENERAL, of these specifications.

22-05 CAST-IRON PIPE:

a. Material:

(1) Cast-iron pipe 4 inches in diameter and larger shall conform to the American Water Works Association Standard Specifications for Cast Iron and Special Fittings for Class D waterworks pipe or to the requirements of Federal Specification WW-P-421, class 150

(2) Tests:

(a) Requirements and Procedure: The pipe shall be tested in accordance with the requirements of Federal Specification WW-P-421.

(b) Reports: Certified records of the tests made by the manufacturer or by an approved commercial laboratory, or by both, as required by the Contracting Officer, shall be submitted to the Contracting Officer with each shipment of pipe.

(3) Cast-iron specials and fittings for pipe 4 inches and larger in diameter shall be Class D, conforming to the latest standard specification adopted by the American Water Works Association, unless otherwise specified.

(4) Joints shall be of the bell-and-spigot type. Jointing material shall be of the kind, make and quality approved by the Contracting Officer, and shall conform to the following requirements:

(a) Joint packing shall be of the best quality, clean, dry, long-fiber, hemp or jute, square-braided or hard-twisted, or a substitute acceptable to the Contracting Officer. Unless otherwise approved by the Contracting Officer, braided or twisted joint packing shall be not less than 1/2 inch in size.

(b) Calking lead shall conform to the requirements of Federal Specification QQ-L-156, type I.

b. Installation:

(1) Handling: Pipe and accessories shall be handled in such manner as to insure delivery on the work in sound, undamaged condition. Particular care shall be taken not to injure the pipe coating. No other pipe or material of any kind shall be placed inside of a pipe or fitting after the coating has been applied.

(2) Cutting of pipe shall be done in a neat and workmanlike manner without damage to the pipe. Unless otherwise authorized by the Contracting Officer, cutting shall be done by means of an approved type of mechanical cutter. Wheel cutters shall be used when practicable.

(3) Placing and Laying: While suspended in the sling and before lowering into the trench, the pipe shall be inspected for defects and tapped with a light hammer to detect cracks. Defective, damaged or unsound pipe will be rejected. Deflections from a straight line or grade, as required by vertical curves, horizontal curves, or offsets, shall not exceed 6/D inches per linear foot of pipe for pipe less than 14 inches in nominal diameter, nor 465/D inches per linear foot of pipe for pipe 14 inches and larger in diameter, where D represents the nominal diameter of the pipe expressed in inches, between the center lines extended, or any two connecting pipes. If the alignment

requires deflections in excess of these limitations, the Contractor shall provide special bends or a sufficient number of shorter lengths of pipe to provide angular deflections within the limit set forth, as approved by the Contracting Officer. After placing a length of pipe in the trench, the packing material for the joint shall be held around the bottom of the spigot so that the packing will enter the bell as the pipe is pushed into position. The spigot shall be centered in the bell and the pipe pushed into position and brought into the required alignment. Except where necessary in making connections with other lines, or as authorized by the Contracting Officer, pipe shall be laid with the bells facing in the direction of laying. Except as closures, not less than 2 lengths of pipe shall be in position ahead of each joint, with packing installed and earth fill tamped along side of the pipe, before the joint is poured.

(4) Joints: Before jointing bell-and-spigot pipe, all lumps, blisters, and excess coating material shall be removed from the bell-and-spigot ends of the pipes. All oil or grease shall be removed. The outside of the spigot and the inside of the bell shall be wire-brushed and wiped clean and dry.

(a) Joint Packing: The packing shall be carefully placed and tightly calked to a uniform thickness. No loose or frayed ends of fibre shall protrude into the space to be filled with joint filler. Each joint shall be carefully inspected and checked for proper depth before the joint runner is attached.

(b) Lead-Filled Joints: The depth of lead in lead-filled joints shall be not less than 2-1/4 inches back of the face of the bell. Lead shall be heated in a melting pot kept near the joint to be poured, brought to proper temperature, so that when stirred the surface will show a rapid change in color, and when poured into the joint space, will insure a perfect joint. Before pouring lead all scum shall be removed. The joint runner shall fit snugly against the face of the bell and the outside of the pipe and shall be dammed with clay at the pouring gate, to assure filling the joint even with the top of the bell. Each joint shall be made with one pour completely filling the joint space. The calking shall be done by competent mechanics, in such manner as to secure tight joints without overstraining the bells. The calking shall progress toward the joint gate. If the packing has been insufficiently calked, permitting the lead to be driven during calking to a depth more than 1/4 inch from the face of the bell at any point, the lead shall be removed and the joint remade.

(5) Incidental Items of Work: Fittings at bends in the pipe line shall be firmly wedged against the vertical face of the trench, to prevent the fittings from being blown off the lines when under pressure. Where pipe ends are left for future connections they shall be valved, plugged, or capped, as directed by the Contracting Officer. Where connections are made between new work and existing mains, the connections shall be made by using specials and fittings to suit the actual conditions. Thrust and anchor concrete blocks shall be placed where shown on the drawings or directed by the Contracting Officer.

(6) Tests: After the pipe is laid, the joints completed, and the trench partially backfilled, leaving the joints exposed for examination, the newly laid piping or any valved section of piping shall, unless otherwise specified, be subjected to a pressure test of 50 pounds per square inch in excess of what static pressure at the points of reading will be when the system has been put in operation. All exposed pipe, joints, fittings, valves and hydrants shall be carefully examined during the open trench test. Lead joints showing visible leakage shall be calked until tight. Where the joints are made with sulphur compound and show seepage or slight leakage, only such joints as may be defective shall be cut out and replaced as directed by the Contracting Officer. Cracked or defective pipe, fittings, valves, or hydrants disclosed in the pressure test shall be replaced by the Contractor with sound material, and the test shall be repeated until the test results are satisfactory to the Contracting Officer. Where an actual visible inspection of each joint cannot be made because of the necessity for immediate backfilling, where the line is laid below water level and it is impracticable to lower the water level by pumping and the leakage diminishes as the material in the joints ages, suitable means shall be provided by the Contractor for determining the quantity of water lost by leakage under normal operating pressure. No piping installation will be accepted until or unless this leakage (evaluated on a pressure basis of 150 pounds per square inch) is less than 100 U.S. Gallons per 24 hours per mile of pipe per inch nominal diameter for pipe in 12-foot lengths, 75 gallons for pipe in 16-foot lengths and proportionately varied for other lengths of pipe. In calculating leakage the Contracting Officer will make allowance for added joints in the pipe line above the normal for unit lengths of pipe. Should any test of combined sections of pipe line disclose leakage per mile greater than that hereinbefore specified, or if individual sections show leakage greater than the specified limit, the Contractor shall locate and repair the defective joints until the leakage is within the specified limits. Pipe lines jointed with lead may be subjected to hydrostatic pressure, inspected, and tested for leakage at any time after partial completion of backfill. Leakage loss shall be within the allowances hereinbefore specified.

22-06 WROUGHT-IRON PIPE:

a. Wrought-iron pipe 3 inches and less in diameter shall conform to the requirements of Federal Specification WW-P-441, class A, galvanized, with screw joints.

b. Specials and fittings for galvanized wrought-iron pipe shall be galvanized malleable iron, conforming to the requirements of Federal Specification WW-P-521, type II.

22-07 SERVICE LINES: Unless otherwise shown on the drawings, or specified, all service lines larger than 3 inches in diameter shall be constructed of cast-iron pipe. Service lines 3 inches and smaller in diameter shall be constructed of galvanized wrought-iron pipe. All pipe and fittings used in the construction of service lines shall conform to the applicable requirements for water lines. Service shall include the lines to, and connections with, the building service at a point approximately 5 feet outside the building where such building service exists.

Where building services are not installed, the Contractor shall terminate the service approximately 5 feet from the site of the proposed building at a point designated by the Contracting Officer. Such service lines shall be closed with suitable plugs or caps. All service stops and gate valves shall be provided with extension service boxes of the lengths required by the depths of the service line stops or valves. Service lines shall be constructed in accordance with the following requirements.

a. The connection to the main for service lines 1-1/2 inches and smaller in diameter shall consist of a corporation type stop and a lead or copper gooseneck, with a service stop.

b. Service lines 2 inches in diameter shall be connected to the main with a rigid connection or a corporation-type stop and lead or copper gooseneck and shall have a gate valve. Where more than one gooseneck connection to the main is required for an individual service, such connections shall be made with standard quality branch connections in conformance with recognized standard practice. The total clear area of the branches shall be at least equal to the clear area of the service which they are to supply.

c. Service lines larger than 2 inches in diameter shall be connected to the main by means of a rigid connection and shall have a gate valve.

d. Miscellaneous Items:

(1) Tapped tees for future connections shall be installed where shown on the drawings or directed by the Contracting Officer.

(2) Corporation stops shall have water works standard thread on the inlet end, with flanged joint couplings or wiped joints for connections to goosenecks.

(3) Lead pipe for gooseneck connections shall conform to the applicable requirements of Federal Specification WW-P-325, class 100. Copper tubing for gooseneck connections shall conform to the applicable requirements of Federal Specification WW-T-799, type K. Length of connections shall be in accordance with standard practice.

(4) Service stops shall be water-works ground-key type, oval flow way, tee handle, without drain. All parts shall be of 85-5-5-5 cast red brass with female IPS connections and shall be designed for a minimum hydraulic pressure of 200 pounds per square inch.

(5) Service boxes shall be of cast iron. Extension service boxes of the required length and having either screw or slide type adjustment, shall be installed at all service-box locations. The boxes shall have housings of sufficient size to completely cover the service stop and shall be complete with identifying covers. Where water mains are located in paved streets having curbs, the boxes shall be located directly back of the curbs. Where no curbing exists, service boxes shall be installed in accessible locations, beyond the limits of streets, walks, and driveways.

22-08 GATE VALVES shall be designed for a minimum water working pressure of not less than 150 pounds per square inch. Valves shall have bell or spigot ends or screw joints as required for the piping in which they are installed. Gate valves shall have a clear waterway equal to the full nominal diameter of the valve, and shall be opened by turning to the left. The operating nut or wheel shall have an arrow, cast in the metal, indicating the direction of opening. Each valve shall have the maker's initials, pressure rating, and year in which manufactured, cast on the body. Prior to shipment from the factory each valve shall be tested by hydraulic pressure equal to twice the specified water working pressure.

a. Valves smaller than 2 inches shall be all brass and shall conform to the requirements of Federal Specification WW-V-54.

b. Valves 2 inches and larger shall be iron-body, brass-mounted and shall conform to the Standard Specifications of the American Water Works Association 7F.1, or to the requirements of Federal Specification WW-V-58.

22-09 FIRE HYDRANTS shall have a 6-inch bell connection, two 2-1/2-inch hose connections and one 4-1/2-inch pumper connection. The 2-1/2-inch outlets shall have 60-degree V-threads, 7-1/2 threads to the inch, and the outside diameter of the external threads shall be 3-1/16 inches. The 4-1/2 inch pumper connection shall have 4 threads to the inch, and the outside diameter of the external threads shall be 5-3/4 inches. The hydrants shall be designed for 150 pounds working pressure or 300 pounds hydrostatic test pressure, and shall conform to the latest specifications of the American Water Works Association. All working parts shall be bronze. All hose threads shall be National Standard threads. Hydrants shall be connected to the mains by 6-inch-diameter pipes. Design, material and workmanship shall be similar and equal to the latest stock pattern ordinarily produced by approved American manufacturer. Hydrants shall be painted one coat of red lead paint and 2 finishing coats of approved paint of the color directed by the Contracting Officer. Hydrants shall have 5-inch valve openings.

22-10 VALVE BOXES shall be of cast-iron of extension type with screw or slide type adjustment and with flared base. The minimum thickness of metal shall be 3/16 inch. The cover shall have the word "WATER" cast in the metal. Boxes shall be installed over each outside gate valve unless otherwise shown on the drawings. The boxes shall be of such length as will provide, without extension, a cover of not less than 2 feet over the pipe.

22-11 HYDRANTS, VALVES AND VALVE BOXES shall be installed in the lines as shown on the drawings and directed by the Contracting Officer. Hydrants, valves and valve boxes shall be set plumb, and centered, with valve boxes placed directly over the valves. Valve boxes shall, if possible be located outside the area of roads and streets. Earth fill shall be carefully tamped around the valve box to a distance of 4 feet on all sides of the box, or to the undisturbed trench face if less than 4 feet. Hydrants shall be set at such elevations that the connecting pipe will

have the same depth of cover as the distributing mains. The hydrant shall be set upon a slab of stone or concrete not less than 4 inches thick and 15 inches square. The back of the hydrant, opposite the pipe connection, shall be firmly wedged against the vertical face of the trench to prevent the hydrant from blowing off the line. If the character of the soil is such that in the opinion of the Contracting Officer the hydrant cannot be securely wedged, bridle rods and rod collars shall be used. Bridle rods and rod collars shall be not less than 3/4 inch stock and shall be protected by a coat of acid-resisting paint. Not less than 7 cubic feet of broken stone shall be placed around the base of the hydrant to insure drainage. The backfill around hydrants shall be thoroughly compacted to the grade line in a manner satisfactory to the Contracting Officer. Hydrants and valves shall have the interiors cleaned of all foreign matter before installation. Stuffing boxes shall be tightened and the hydrant or valve shall be inspected in opened and closed positions, to see that all parts are in working condition. Valve boxes located in roads or sidewalks shall be protected by a concrete slab in accordance with the detail shown on the drawings.

22-12 STERILIZATION: The entire water-distribution system shall be thoroughly sterilized with a solution containing not less than 50 parts per million of available chlorine. The chlorinating materials shall be either liquid chlorine conforming to [redacted] or calcium hypochlorite or chlorinated lime conforming to Federal Specification O-C-114, and shall be introduced into the system in a manner approved by the Contracting Officer. The sterilizing solution shall be allowed to remain in the system for a period of 8 hours, during wich time all valves and faucets shall be opened and closed several times. After sterilization, the solution shall be flushed from the system with clean water until the residual chlorine content is not greater than 0.2 part per million, unless otherwise directed.

STATINTL

22-13 CLEAN UP: Upon completion of the installation of the water supply lines, distribution systems and appurtenances, all debris and surplus materials resulting from the work shall be removed.